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Temporal Lobe Epileptic Signs and Correlative Behaviors Displayed by Normal Populations

MICHAEL A. PERSINGER
KATHERINE MAKAREC
Behavioral Neuroscience Laboratory
Laurentian University, Canada

ABSTRACT. With regard to epileptic signs and correlative behaviors, one hypothesis is that the experiences and nonconvulsive behaviors of patients with electrical foci within the temporal lobe are also displayed, but with less intensity, by normal people. If this is correct, then there should be quantitative relationships between the numbers of major complex partial epileptic signs (CPES) and the occurrence of other frequent clinical experiences and behaviors. An inventory to answer this question was developed. Over a 3-year period, 414 (6 groups) university students were administered an inventory that included themes of CPES as well as control and information items. Strong correlations were consistently found between CPES scores and reports of paranormal (mystical, with religious overtones) experiences and "a sense of presence." Results from three personality (CPI, MMPI, and IPAT anxiety) inventories clearly demonstrated similar profiles. In addition to being more anxious, people who displayed higher CPES scores were more suspicious, aloof, stereotyped in their behavior, ruminative (overthinking), intellectually inefficient, and overly judgmental. CPES scores were significantly ($p < .001$) correlated with the schizophrenia and mania subscales of the MMPI. The results suggest that functional hyperconnectionism of cortical-limbic systems within the brain may be more prevalent in the normal population than previously suspected.

ACTIVE ELECTRICAL FOCI or surgical stimulation of the temporal lobes have been associated with specific psychological experiences. They include anxiety or fear, vestibular changes (vibrations or uplifting sensations), audi-

Requests for reprints should be sent to Michael A. Persinger, Behavioral Neuroscience Laboratory, Department of Psychology, Laurentian University, Sudbury, Ontario, Canada P3E 2C6.

tory impressions, forced or intrusive thinking, dreamy states, and sometimes frank hallucinations (Gloor, Olivier, Quesney, Andermann, & Horowitz 1982; Halgren, Walter, Cherlow, & Crandall, 1978; Horowitz & Adams, 1970; Stevens, Mark, Erwin, Pacheco, & Suematsu, 1969; Wieser, 1983).

Some of these experiences are remarkably similar to those that have been labeled *paranormal* or mystical phenomena (Neppe, 1983; Persinger, 1983). They include reports of deja vu, sensations of "a presence" (usually with mystical or religious overtones), leaving the body (mental diplopia; out-of-body experience), and precognition (knowing what is about to happen). Frequently, the experiences are affected by situational context and modified by amnesia (Horowitz & Adams, 1970).

There is also evidence that people who display recurrent electrical foci within the temporal lobe may also show specific interictal behaviors (Bear & Fedio, 1977; Hermann & Whitman, 1984). These patients are often diagnosed with temporal lobe, complex partial, or limbic epilepsy. Typical interictal behaviors include increased concern with religious or philosophical issues that are paralleled by hypergraphia, the tendency for detailed and extensive writing (Waxman & Geschwind, 1974). The speech of these patients is dominated by circumstantiality and there is a concomitant perseveration or viscosity in social settings. Anger, diminished sex drive, and humorless sobriety have also been reported (Geschwind, 1983).

Bear (1979) hypothesized that these symptoms reflect a sensory-limbic hyperconnection syndrome. Later, Geschwind (1983) suggested that this syndrome is the result of the presence of an intermittent spike focus within the temporal lobes. This activity leads to a heightened emotional response to many stimuli. Bear, Schenk, and Benson (1981) found an increased autonomic responsiveness to emotional and neutral stimuli in patients with diagnosed temporal lobe epilepsy relative to a reference group. Enhanced electrical responses from the amygdala of temporal lobe epilepsy patients who were exposed to unexpected or unusual stimuli have also been reported (Halgren et al., 1980). This may explain why people with electrical foci within the temporal lobe are prone to deepened and widened affect that is often manifested by the "sense of the personal" (events are explained as signs or indicators of destiny or the experience of profound, cosmic significance).

Persinger (1983, 1984a, 1984b) and Persinger and Valliant (1985) have suspected that the symptoms of limbic stimulation or limbic dyscontrol are not unique to patients with nonconvulsive, temporal lobe epilepsy. These symptoms should be evident as less severe manifestations within the normal population; these symptoms and experiences would be normal displays that reflect the intrinsic function of temporal lobe structures. Unlike the displays by patients with electroencephalographically determined foci, however, these experiences should be less frequent within the normal population and would not necessarily dominate the person's behavior.

Temporal lobe experiences within the normal population would be precipitated by physical conditions that promote electrical lability within deep structures such as the hippocampus and amygdala (Persinger, 1983). Precipitating conditions would include hypoglycemia (prolonged fasting), fatigue, hypoxia, drug-induced alterations in vascular flow, and the biochemical changes evoked by personal crises (such as the death of a loved one). The existence of and intercorrelation among these symptoms may be even clearer in the normal population because they would not be masked by the neuropsychological deficits that frequently accompany epilepsy.

Recent electrophysiological work by Goldensohn (1983) supported the existence of a continuum of temporal lobe lability in the human population. He found that the classic epileptogenic focus, as defined by an electroencephalographic (EEG) presence, is composed of many, normally undetectable foci whose density and number determine the appearance of the EEG focus. These smaller foci are generated by areas approximately the width of a cortical column. They may remain active but recondite for protracted periods or be stimulated after refractory intervals by the appropriate microbiochemical changes.

These observations are compatible with the model of Teyler and DiScenna (1985) and the observations of Hess, Urech, and Wieser (1982). Teyler and DiScenna argued that the hippocampus, an extremely electrically labile and vascularly sensitive structure, functions as an index system. It evokes specific information within cortical columns. Recurrent stimulation of the same index region in the hippocampus due to transient changes in blood chemistry, vascular tone, or microneuronal environment, could activate specific columns. Hess, Urech, and Wieser (1982) found that the vast majority of K-complexes during sleep must be considered as "epileptic" due to spikes within the hippocampus and amygdala. Focal bursts of activity or "miniseizures" (Stevens, 1982) occur in the limbic forebrain during all stages of sleep; they are correlated with the pulsed release of hormones (and the display of related behavior). In summary, spike activity within the deep structures is a normal phenomenon whose intensity and duration are influenced by many of the conditions that accompany ictal-like experiences.

To study the existence of temporal lobe signs within the normal population, the Personal Philosophy Inventory (PPI) was developed. In addition to a variety of control and information statements, it contains items that were designed as less intense equivalents of the most frequent experiences or behaviors that are reported by patients who were diagnosed with complex partial epilepsy. Many of these signs are also reported by patients during electrical stimulation.

Previous studies (Persinger, 1984; Persinger & Valliant, 1985), have evaluated the internal consistency of clusters (8 to 10 times each) that reflect varying intensities of temporal lobe signs in conjunction with two clusters of

control items. Scores for clusters of temporal lobe and mystical experience items always loaded clearly on one factor, whereas the control clusters always loaded clearly on another factor. Similarly, the amount of alpha activity from the occipital lobe was not correlated significantly with scores on the temporal lobe clusters.

Quantitative EEG analyses of subjects who were assigned to a fixed eyes-open or eyes-closed condition in the presence or absence of specific sounds indicate that scores on temporal lobe clusters are significantly correlated with the amount of alpha activity over the temporal lobes but not over the occipital lobes (Makarec & Persinger, in press). Previous quantitative studies (Makarec & Persinger, 1985) with a special population of poets and their reference group indicated the numbers of spikes from the temporal region but not the occipital region were correlated ($r = 0.50$) with the number of temporal lobe signs and the propensity for religiosity.

This study was designed to determine the internal consistency between clusters or signs that reflect "temporal lobe experience," the reliability of these relationships across samples of the normal population, and the major personality characteristics of people who score highly on these clusters. It was expected that the personality characteristics would be a less intense reflection of patients with foci within the temporal lobe. Consequently, normal subjects who scored highly on the cluster of complex partial epileptic signs (CPES) should also demonstrate a propensity for stereotyped, "forced" and ruminative thinking, consistent and persistent delusions (paranoia), altered affect and persistent depersonalization, and enhanced anxiety or fear.

Several specific hypotheses were generated. Positive correlations between CPES scores and (a) mystical-paranormal, sense of presence, and a history of "personal" writings (i.e., other temporal lobe-related behaviors); (b) scores on the MMPI scales of paranoia, schizophrenia, mania, and a special scale of perseverative or ruminative thinking; and (c) scores on the IPAT anxiety and the MMPI affective anxiety scales were expected. In comparison, strong negative correlations were expected between the CPES measure and scores on the California Psychological Inventory (CPI) scales that refer to well being, intellectual efficiency, and spontaneity. In other words, normal people who score high on the CPES cluster should be more stereotyped, worrisome, and less intellectually efficient than those who score low.

Method

Subjects

Group 1. A total of 43 males and 65 females from an evening, first-year introductory psychology course served as subjects. Their ages ranged from 21 to 61 years ($M = 30$). They were tested during the 1982 fall semester.

Group 2. A total of 12 males and 29 females from an evening, second-year psychology course served as subjects. Their ages ranged from 20 to 62 years (M = 27). They were tested during intersession (May-June), 1983.

Group 3. A total of 38 males and 79 females from an evening, first-year psychology course served as subjects. Their ages ranged from 20 to 51 (M = 27). They were tested during the winter semester of 1983.

Group 4. A total of 11 males and 22 females from a third-year psychology course and from a local group of student poets served as subjects. Their ages ranged from 20 to 48 years (M = 27). They were tested during the summer semester of 1984.

Group 5. A total of 51 males and 66 females from an evening, introductory psychology course served as subjects. Their ages ranged from 18 to 45 years (M = 25). They were tested during the winter semester of 1985.

Group 6. A total of 12 males and 20 females from an evening, introductory psychology course served as subjects. Their ages ranged from 20 to 52 years (M = 25). They were tested during intersession (May-June), 1985.

The Instrument: The PPI

The Personal Philosophy Inventory (PPI) is composed of 140 items. Twenty of these items refer to information (e.g., hand preference, church attendance) that may be relevant to temporal lobe function. There are two items per theme to check for consistency. Another 30 items are concerned with beliefs that range from exotic fantasies such as "I would like to time travel" to extreme religious opinions such as "If God told me to kill I would do it in His name" and "The existence of God cannot be explained by science." Most of the items from the Lie scale of the MMPI are also included.

The major group of items in the PPI are used to compose the temporal lobe-relevant and mundane experience clusters. The latter clusters contain items that are used as controls for the response style of the subject. These control items involve frequent, mundane, and nonspecific statements. A few other control items (not included in these clusters) are used for specific purposes, such as to identify silly responders. An example of these items is "I have been taken aboard a spaceship." People who respond affirmatively to these items were dropped from the study. They comprised between 0 to 2% of any given group. Subjects who responded *yes* to an item concerning a history of epileptic seizures were also excluded.

The control cluster is composed of 16 items (shown in Appendix 1). For statistical, theoretical, and psychometric analyses, two subclusters were de-

veloped. The first is called mundane cognitive experiences (odd-numbered items in Appendix 1); these items serve to determine the *yes* or *no* response patterns of the subject. The second cluster is called the mundane proprioceptive experiences (MPE); these items emphasize more visceral and proprioceptive experiences and help determine the subject's propensity to report "proprioceptive" experiences in general. This cluster is considered to be essential because the expected temporal lobe signs tend to be dominated by internal experiences. The items in the control cluster are distributed throughout the PPI.

About 40 of the items are concerned with possible temporal lobe indicators. The major cluster, Complex Partial Epileptic Signs (CPES), is composed of 16 items (Appendix 2). They refer to experiences that are very similar or analogous to those most frequently reported by patients with electrically verifiable foci within the temporal lobe. Many of these items represent experiences that have been evoked by direct surgical stimulation. Responses on these items are significantly correlated with electroencephalographic activity above the temporal lobes but not with the occipital lobes of normal subjects (Makarec & Persinger, 1985, in press). Factor analyses of those items that contained proportions of *yes, no* answers between 30 and 70% (to minimize distortion by skewness) indicated that the items are not redundant. These items are also distributed throughout the PPI. The test-retest correlations for the CPES and control clusters were 0.85 to 0.95 after 10 days and 0.60 to 0.70 after 100 days (Persinger, 1985).

Other items that refer to temporal lobe-specific experiences are used to test the internal consistency of the hypotheses and to answer specific questions. For this study, three small clusters of items were included: sense of presence (3 items); subjective paranormal experiences (5 items); and hyperwriting (5 items). The sense of presence included items such as "At least once in my life very late at night, I have felt the presence of another being" and "I have been visited by a spiritual being." The paranormal cluster involved "Once I thought about a person whom I had not seen for a while and then saw the same person a few moments later" and "My soul sometimes leaves my body." The hyperwriting cluster was composed of items that were considered analogous to the increase in writing interest displayed by patients with temporal lobe foci but who show no profound neuropsychological deficit. These statements include "After writing poetry or prose, I feel better" and "I keep a diary."

Procedure

All subjects were administered the PPI (which generally takes approximately 20 to 30 min) in the classroom setting, usually during a period that was normally reserved for psychological or academic assessment. In addition,

Groups 2 and 3 were also administered the California Personality Inventory (CPI) whereas Groups 4 and 5 were also given the Minnesota Multiphasic Personality Inventory (MMPI). Group 6 received Rotter's Internal-External Locus of Control and the IPAT Anxiety Questionnaires. The PPI was always given first. All subjects received a 2% bonus mark for their participation in the experiment.

Each subject's responses (0 = *no;* 1 = *yes,* or the equivalent for negative response items), age, and gender were loaded onto a DEC 2020 System computer. The percentages of yes responses for the different cluster of items were determined simply by adding the number of yes responses for each cluster, dividing by the total number of items per cluster, and multiplying by 100. Standardized MMPI scores in Group 4 were determined manually whereas those in Group 5 were completed by a commercial software package. Standardized CPI scores for Groups 2 and 3 and the I-E and IPAT scores for Group 6 were determined manually.

Both Pearson's r and Spearman's rho correlations were completed between the control and temporal lobe-relevant clusters and between these scores and the appropriate personality inventories for each group. Scattergrams were completed for these analyses in order to visualize the relationships and to determine possible nonlinear functions. In addition, factor analyses were completed for the scores (percentage of yes responses) of the two control clusters (mundane experience), two subclusters (odd- versus even-numbered items) for the CPES cluster, and the subjective paranormal experience cluster. There were no overlaps in similarity between the items of the CPES and paranormal clusters. Moreover, although subjects readily identified the five items of the paranormal cluster as clearly parapsychological or "ESP"-phenomena, none of the items of the CPES cluster were consistently identified as such. According to the hypothesis, however, people's scores on the CPES and paranormal clusters should be strongly correlated even if they are not perceived as associated phenomena. When appropriate, partial correlations were determined; one-way analyses of variance (ANOVAs) were used to test for sex differences. Significance levels were set at $p \leq .01$. All analyses were completed by SPSSX software on a DEC 2020 System computer.

Results

The means and standard deviations for the percentage of affirmative responses to the CPES and the control and paranormal clusters are shown in Table 1. The number of subjects per group and the number of items per cluster are also shown. The scores on each cluster are very consistent across the six groups. The means and standard deviations were similar for both the larger and smaller classes. There were no statistically significant differences in mean scores for any of the clusters between sexes.

TABLE 1
Means and standard deviations (in parentheses) for the percentage of yes responses for clusters of items that contained CPES, subjective paranormal experiences, and mundane experiences (control items)

		PPI clusters		
Group	*N*	CPES (n = 16)	Paranormal (n = 5)	Mundane (n = 16)
1	108	29(19)	34(23)	78(11)
2	41	32(18)	37(22)	76(11)
3	83	33(19)	42(25)	79(11)
4	33	27(22)	35(29)	77(11)
5	117	32(18)	37(22)	78(12)
6	32	33(19)	35(20)	78(12)
Total	414			

Note. The numbers of items per cluster are indicated.

Factor analyses (principal component; varimax rotation) of the cluster scores (percentage of yes responses) for the two temporal lobe subclusters (eight items each), the two control clusters (eight items each), and the paranormal (five items) cluster (a total of five scores for each subject) produced very similar results for all six groups. Only two factors emerged for each group. The first factor was loaded by only the two temporal lobe and the paranormal clusters. Eigenvalues ranged from 2.06 to 2.45 and the factor explained between 41% to 47% of the variance. The two control clusters never loaded (rs less than 0.20) on the first factor but instead loaded on a second factor. Eigenvalues ranged from 1.07 to 1.46. This factor explained an additional 22% to 26% of the variance and was never loaded significantly ($r < 0.20$) by the temporal lobe or paranormal clusters. Correlations between the two temporal lobe clusters (odd- versus even-numbered items) ranged from 0.55 to 0.73 ($p < .001$) for the six groups whereas correlations for the two control clusters (eight items each) ranged from 0.11 to 0.31 ($p > .01$).

Table 2 demonstrates the bivariate correlations (rs) between the CPES cluster and the subjective paranormal and control clusters; the results support the first hypothesis that high CPES scores are associated with frequent reports of subjective paranormal experiences. All groups showed highly significant ($p < .001$) correlations between the two clusters. The r values were almost identical ($\pm$ 0.02) to the rho values. In comparison, CPES responses were not correlated strongly with the responses on the control clusters and they were not correlated significantly with the paranormal items. Neither the CPES nor the control cluster responses were systematically correlated significantly with the Lie scale items from the MMPI.

TABLE 2
Pearson's *r* correlations between responses on the CPES, mundane experience, subjective paranormal experience, and Lie (MMPI scale items) clusters

Group	CPES with mundane experiences	CPES with paranormal experiences	Paranormal with mundane experiences	CPES with Lie scale	Mundane experiences with Lie scale
1	0.06	0.54**	0.13	0.03	0.13
2	0.20	0.60**	0.38**	0.17	−0.23
3	0.07	0.56**	0.07	0.06	−0.23
4	−0.16	0.66**	0.01	0.07	−0.27
5	0.15	0.48**	0.08	0.03	−0.31**
6	0.29	0.52**	0.08	−0.23	0.22

* $p < .01$. ** $p < .001$.

The hypothesis that a sense of presence should be correlated with CPES was strongly supported as well. As shown in Table 3, all but Group 5 demonstrated this relationship. All six groups, however, displayed strong ($r > 0.50$) significant correlations between a sense of presence and the experiences of subjective paranormal experiences. A systematic relationship between CPES and writing behaviors, such as poetry and records about personal thoughts and feelings, was not as apparent. These clusters were significantly correlated with CPES in only four of the six groups.

TABLE 3
Pearson's *r* correlations between responses on items that composed the CPES, paranormal experience, sense of "a presence," and the "hyperwriting" clusters

Group	CPES with "presence"	Mundane experiences with "presence"	Paranormal experiences with "presence"	CPES with hyperwrite	Mundane experiences with hyperwrite
1	0.45**	0.00	0.55**	0.26*	0.10
2	0.49**	0.35*	0.65**	−0.09	0.11
3	0.32**	0.04	0.46	0.17	0.02
4	0.63**	−0.08	0.43*	0.52**	−0.01
5	0.30**	0.18	0.40**	0.48**	0.10
6	0.18	0.11	0.52**	0.38**	−0.17

* $p < .01$. ** $p < .001$.

Both groups (2 and 3) that had received the CPI and the PPI demonstrated the same relationships between the clusters and the scales. The results are shown in Table 4. People who reported more frequent CPES also scored lower on the Well-being (Wb), Tolerance (To), Achievement via Independence (Ai), and Intellectual Efficiency (Ie) scales of the CPI. The scales were not strongly or consistently correlated with responses on the control clusters.

According to the CPI manual, these results indicated that people who scored higher on the CPES cluster were more likely to be (a) worrisome, disillusioned, and constricted in thought and action (low Wb); (b) suspicious, aloof, overly judgmental, and disbelieving in personal and social outlook (low To); (c) inhibited and anxious, as being submissive and compliant before authority (low Ai), and (d) cautious, confused, and stereotyped in thinking (low Ie).

Results of the MMPI for Groups 4 and 5 are shown in Table 5. The profiles for all but two subjects were valid. Again the results were similar for both groups. Only the following scales were significantly correlated with the CPES cluster: (for Group 4), Paranoia, $M = 59$, $SD = 10$; Psychasthenia, $M = 57$, $SD = 12$; Schizophrenia, $M = 60$, $SD = 13$; and Mania, $M = 61$, $SD = 13$. The means and standard deviations for Group 5 were, respectively: $M = 61$, $SD = 10$; $M = 60$, $SD = 10$; $M = 64$, $SD = 13$; and $M = 64$, $SD = 11$. The strongest correlations were between the Schizophrenia and Mania scales and the CPES cluster.

Because some of the items on the CPES cluster were very similar to those in the MMPI, a modified CPES scale without Items 7 and 11 (from Appendix 2) was computed. There was no change in the magnitude of the correlations. As an indicator of reliability, the items from the MMPI Lie scale

TABLE 4
Pearson's *r* correlations between responses on the CPES and mundane experience clusters with scales from the California Psychological Inventory for Groups 2 and 3

	PPI Cluster			
	CPES		Mundane	
CPI Scale	Group 2 ($n = 41$)	Group 3 ($n = 83$)	Group 2 ($n = 41$)	Group 3 ($n = 83$)
Well-being	−0.60*	−0.50*	−0.13	−0.12
Tolerance	−0.51*	−0.45*	−0.06	−0.10
Achievement-Independence	−0.59*	−0.41*	0.01	−0.20
Intellectual Efficiency	−0.58*	−0.36*	−0.04	−0.07

* $p < .001$.

TABLE 5
Pearson's *r* correlations between scores on the CPES and mundane (control) clusters and scales of the MMPI for Groups 4 and 5

	PPI Cluster			
	CPES		Mundane	
MMPI Scale	Group 4 (n = 33)	Group 5 (n = 117)	Group 4 (n = 33)	Group 5 (n = 117)
Paranoia	0.48*	0.20*	−0.04	0.06
Psychasthenia	0.48*	0.22*	−0.11	−0.01
Schizophrenia	0.54**	0.37**	−0.31	0.12
Mania	0.66**	0.45**	−0.18	−0.01

* $p < .01$. ** $p < .001$.

were correlated with the modified items from the portion of that scale contained in the PPI; the correlations for the two groups were 0.88 and 0.90, respectively.

Additional scales from the commercial software package of the MMPI were analyzed for Group 5 only (see Table 6). The scales were Overthinking (which contains the theme of rumination), Intellectual Efficiency, Affective Anxiety, Social Adjustment, and Fundamental Religious Attitudes. Neither the control nor the CPES clusters were significantly correlated with the latter two scales. CPES scores, however, were significantly correlated (r = 0.50) with the Overthinking scale; it was also weakly but significantly correlated with the control cluster. After partial correlations by CPES, the correlation between the control cluster scores and overthinking was no longer statistically

TABLE 6
Correlations between the CPES and control clusters and special MMPI scales (computed by a commercial software package) for Group 5

	PPI Cluster	
Scale	Mundane	CPES
Overthinking	0.28*	0.50**
Intellectual Efficiency	0.07	−0.26**
Affective Anxiety	0.04	0.29**
Social Adjustment	0.09	0.01
Fundamental Religious Beliefs	0.10	0.15

*$p < .01$. **$p < .001$.

significant ($p > .01$). The CPES scores, however, were positively correlated with affective anxiety ($r = 0.29$) and negatively correlated with intellectual efficiency ($r = -0.26$); these MMPI scales were not correlated with the control cluster ($r = 0.07$ and 0.04, respectively).

The results of the comparisons between the IPAT anxiety and CPES clusters further verified and supported the MMPI and CPI analyses (Table 7). A significant positive correlation (0.60) was noted between raw IPAT scores ($M = 35.3$, $SD = 12$) and CPES cluster; the correlation between the IPAT score and control cluster was not significant ($r = 0.26$) statistically. A scattergram demonstrated a clear linear function. The CPES correlation with sten scores was 0.63. With respect to the subscales, the strongest and most striking correlation occurred between the C scale (ego weakness) and the CPES cluster ($r = 0.65$); this was not evident with the control cluster ($r = 0.12$). Neither the CPES nor the control clusters were significantly correlated with Rotter's Internal-External Locus of Control (I-E) Scale ($M = 9.6$, $SD = 4.4$).

Discussion

Bear and Fedio (1977) and Geschwind (1983) have suggested that the epileptic process in the temporal lobe brings about functional hyperconnection between neocortical and limbic structures. Because this new functional matrix disrupts mechanisms that normally inhibit fortuitous sensory-limbic associa-

TABLE 7
Pearson's *r* correlations between the CPES and mundane (control) clusters and various scales of the IPAT Anxiety and Rotter's I-E questionnaires

	PPI Cluster	
Scale	CPES	Mundane
IPAT	0.61**	0.26
A	0.47*	0.16
B	0.60**	0.28
Q3	0.41*	0.34
C	0.65**	0.12
L	0.15	−0.08
O	0.44*	0.14
Q4	0.44**	0.30
Sten	0.63**	0.30
Rotter's I-E	0.11	0.08

* $p < .01$. ** $p < .001$.

tions, experience is suffused with emotional coloration. This leads to specific changes in the patient's behavior, thought, and affect.

It was hypothesized that normal people show similar intercorrelated behaviors because *transient* periods of functional hyperconnectionism also occur. They are due to a variety of situations (e.g., the chemical consequences of grief and crises) that increase the lability of the temporal lobe (Persinger, 1983). The existence of a continuum of temporal lobe lability (and hence a continuum of functional hyperconnectionism) along which each of us are located is suggested; patients with permanent electrical foci within this structure are located at the extreme end of the continuum.

If the continuum exists, it is reasoned that normal people should display quantitative relationships between the numbers of specific temporal lobe signs and related phenomena. Consequently, clusters of items were developed that contained themes of those experiences and behaviors as well as clusters of items that referred to nonspecific or mundane behaviors for control or reference purposes.

For all six groups, people who reported more experiences similar to those of temporal lobe epileptic (TLE) patients (Bear & Bedio, 1977) were also more likely to report different types of paranormal (mystical experiences). Similarly, there were significant correlations between CPES scores and "a sense of presence" in five of the six groups. People who "hyperwrite" (argued to be the weaker analogue of hypergraphia) also showed higher CPES scores in 4 of the 6 groups. These results indicate that CPES, paranormal reports, and the propensity to write or to like poetry and personal notes are interrelated.

The results of the personality questionnaires (the CPI, MMPI, and IPAT anxiety) were also compatible with the hypothesis. The higher the person scored on the CPES cluster, the more likely the person would tend to be (a) cautious, aloof, suspicious, and distrustful in personal and social outlook; (b) constricted in thought and action and stereotyped in thinking; and (c) overly judgmental and submissive and compliant before authority. It is suggested that these behaviors are expected as weaker aspects of (a) the paranoia (delusions), (b) forced thinking and repeated, perseverative behavior, and (c) hypermoralism (in a religious context) that are seen in many temporal lobe epileptic patients (Bear & Fedio, 1977).

The results of the MMPI that was administered to two other groups support and extend the results of the CPI. The four statistically significant scales that were correlated with the CPES were paranoia, psychasthenia, schizophrenia, and mania. The latter two, and particularly mania, were strongly (positively) correlated with CPES scores. Because many CPES items involved detachment or depersonalized themes and ictal experiences of TLE patients often involve "dreamy states" (Weiser, 1983), this correlation is expected. TLE patients who display more imagery during surgical stimulation

tend to score higher on the schizophrenia scale of the MMPI than patients who report anxiety; those patients score more highly on psychasthenia (Halgren et al., 1978). The strong correlation between CPES scores and mania is compatible with the alteration in affect that occurs with TLE patients. In addition to the presence of compelling repetitive thoughts or behaviors, elevated scores may also reflect a widening and deepening of affect that perfuses cognitive processes.

The persistence of the correlation between anxiety and CPES scores is noteworthy. Anxiety reports frequently precede the occurrence of spontaneous (subjective) paranormal experiences; they contain the basic themes of partial complex ictal experiences such as distortions in subjective space-time. In addition, anxiety or fear is probably the most frequent aura of ictal experiences in patients during either spontaneous or surgically induced seizures (Halgren et al., 1978; Weingarten et al., 1977). The observation that TLE patients tend to be more anxious has often been attributed to the social stigma of their disorder. This ubiquitous symptom may also be an aspect of the epileptic process. Recent noninvasive techniques have shown that panic attacks involve alterations in blood flow (and corresponding electrical activity) within the parahippocampal gyrus of the temporal lobe (Reiman et al., 1984).

The temporal lobe signs described in this study are evident, even more conspicuously, in patients who display specific personality disorders. The schizotypal classifications (Diagnostic and Statistical Manual of Mental Disorders, 1980) include magical thinking (within which clairvoyance and telepathy are included), recurrent illusions of sensing the "presence" of a force or a person not actually present, depersonalization, odd speech (i.e., digressive, vague, over-elaborate, or circumstantial), and suspiciousness or paranoid ideation. Often they are seen as cold or aloof with no close friends or confidants. This syndrome is suspected to involve a significant degree of temporal lobe involvement.

A relatively forgotten study by Harper and Roth (1962) highlighted a similar cluster of symptoms that they called the phobic anxiety-depersonalization syndrome. Harper and Roth noted the similarity between the symptoms of these patients and the behaviors of "nonconvulsive" forms of temporal lobe epilepsy. In fact, many of their patients had been diagnosed initially with temporal lobe epilepsy but this was changed when EEG (except in two instances) evaluation indicated no *qualitative* characteristics of TLE. No quantitative EEG analyses were completed. The syndrome usually followed calamitous circumstances such as bereavement, acute physical illness, and childbirth. The experiences included deja vu, formed hallucinations, depersonalization, illusions about body changes, and the idea of presence.

We suspect that the temporal lobe behaviors that are displayed by complex partial epileptics are intrinsic within the normal population. Our hypothesis is that the more frequently the structures within this lobe are subject to

maintained electrical microseizures (as defined by Stevens, 1982), due to exogenous or endogenous sources, the more frequently temporal lobe experiences occur. They are simply exacerbated to the point of being conspicuous in patients with chronic electrical foci within the temporal lobe. Because these experiences are often involved with intense personal meaningfulness, affect decision processes, and include religious or mystical themes, their psychological significance may have been underestimated. In light of the role of these types of experiences in national and international political decisions, the study of "temporal lobe signs" with normal people deserves attention.

Appendix 1
Items that Compose the Two Clusters of Mundane (Control) Experiences

1. Most nights I go to sleep without thoughts or ideas bothering me.
2. I get angry sometimes.
3. I like to buy new things.
4. When I am really upset, I feel my hands shaking.
5. I like to eat well prepared meat.
6. At times I feel like smashing things.
7. Once in a while I laugh at a dirty joke.
8. Most of the time I am happy.
9. At times I feel like swearing.
10. I sometimes feel a sensation or bulge in my abdomen.
11. I gossip a little at times.
12. My face has never been paralyzed.
13. There are some days when I accidently hit my hand on something, smash my fingers, or trip over my own two feet.
14. Sometimes when I am not feeling well I am cross.
15. Once in a while I think of things too bad to talk about.
16. I have a good appetite.

Appendix 2
Items from the CPES Cluster of the PPI

1. Sometimes an event will occur that has special significance for me only.
2. There have been times when I have stared at an object and it appeared to become larger and larger.
3. While sitting quietly, I have had uplifting sensations as if I were driving quickly over a rolling road.
4. When I have a tough decision to make, a sign will be given and I will know what to do.
5. When relaxed or just before falling asleep, I sometimes feel pleasant vibrations moving through my whole body.
6. Sometimes in the early morning hours between midnight and 4:00 a.m., my experiences are very meaningful.
7. I have had a vision.
8. I have heard an inner voice call my name.

9. At least once a month, I experience intense smells that do not have an obvious source.
10. I use "hunches" more than simple learning to solve new problems.
11. I often feel as if things are not real.
12. When I walk up stairs, I sometimes note a strange smell from nowhere.
13. Once, in a crowded area, I suddenly could not recognize where I was.
14. I have had experiences when I felt as if I were somewhere else.
15. I have dreams of floating or flying through the air at least once a year.
16. At least once in my life, just before falling down, I have had the intense sensation of a smell from childhood.

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